June 1953

THE CHEMIST

VOLUME XXX NUMBER 6

Thirtieth Annual AIC Meeting

DR. J. C. WARNER

Receives AIC Gold Medal

(See page 277)

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Report on Scientific Manpower

Dr. Lloyd Van Doren, F.A.I.C.

AIC Secretary

THE National Council at its meeting, May 11, 1953, approved the report of the Committee on Manpower, headed by Dr. Donald B. Keyes, AIC president-elect, that a Presidential Board be set up to handle the situation.

AIC President Work then sent a letter to Charles E. Wilson, Secretary of Defense, recommending this procedure, as follows:

Hon. Charles E. Wilson
Secretary of Defense

Dear Mr. Wilson:

The American Institute of Chemists is a society dedicated to the profession of chemistry and chemical engineering. Our primary interest is in these professions. We do not consider scientific or technical matters, but we do consider very seriously the professional interests of both chemists and chemical engineers. Naturally, we are very much interested in the scientific and engineering manpower problem that exists in this country today.

You, of course, are thoroughly cognizant of the fact that demands for chemists and chemical engineers for defense purposes far exceed the available supply. You are also thoroughly familiar with the fact that this situation will in all probability continue for some years. Therefore, you realize that our professions and this society are vitally interested in the recent bills, H.R. 3893 and S. 1551, which propose to set up, as we understand it, a Presidential Board to handle this vital problem.

After years of consideration on the part of many of us and noting the enormous increase of reservists in this country, we feel that the basic principle of setting up a board of this character, as described in these bills, is the only practical solution to this vital problem.

I am calling this matter to your attention as I am sure that you and the Department of Defense will, sooner or later, take the same attitude as we have in our society.

My thought is that if these bills become law in the near future, considerable confusion will be eliminated for your Department, and the country and you will never regret any favorable action you may take in this matter.

Sincerely yours,
Lincoln T. Work

Copies to:
John A. Hannah
Assistant Secretary of Defense
Arthur Adams, Chairman
Reserve Policy Board, Dept. of Defense
Melvin J. Maas, Member
Res. Pol. Board, Dept. of Defense

Dr. Work also spoke before the Manpower Subcommittee of the National Association of Manufacturers, New York, N. Y., at a luncheon held May 27th, recommending that the presidential commission be set up. In his remarks he stated:

"The great digression for young men in science is the period of military service. Our leadership, confused between the democratic concept that all men are created equal and the actual need for a growing group of young, technical men to serve the industrial arsenal of democracy, has fumbled badly for more than a decade. Military leadership has dominated civilian, and no suitable basic principle as to where men best may serve has been steadily applied. A remedy for the after-college years is the presidential commission proposed under Bills H.R. 3893 — S. 1551.

Through such a commission the 'need of the military and industrial organizations might be established, and men assigned in relation to their skills.'

"If military service is to become a necessary part in the life of every young man, it should be possible to give this training in a way best suited for men having skills for technical operations. This might comprise the use of these men in uniform in the arsenals or in technical field duty with the various units which require such service.

"After a man's period of service, a clear delineation of his reserve obligations needs to be planned."

The Engineering Manpower Commission has reported that the calendar of the House Sub-Committee on Reserve Affairs is heavy and that there is a possibility that time would not permit hearings. Representatives Leroy Johnson and Senator Flanders, sponsors of the above-mentioned bills, have been urged to schedule the bills for hearings if it is at all possible to do so. Though hearings do not result, whatever has been done will add to the general increase of knowledge regarding these important questions.

(See page 311 for information.)

Report on the Astin Affair

(Continued)

Dr. Lloyd Van Doren, F.A.I.C.

Secretary, The American Institute of Chemists

AS INDICATED in the first report on the Astin affair, action was taken in the May Council Meeting, May 11th, and in the Annual Business Meeting, May 12th. The resolution of the Institute was broadly worded and reads as follows:

"The National Bureau of Standards has an enviable record at home and abroad for excellent scientific work. It must not be required to produce results to satisfy special interests, big or small.

"We urge that in the re-evaluation of the functions and objectives of the Bureau, as proposed by the Secretary of Commerce, that due weight be given the necessity of maintaining its disinterested position and scientific independence."

The following points which were discussed are the background of the resolution:

(1) That questions requiring scientific evidence for their solution be resolved by the government only on that basis.

(2) That technical integrity should not be affected by "the play of the market place."

(3) That government documents should not be suppressed, but should be available for proper scientific evaluation.

(4) That the Committee of the National Academy of Sciences be asked to include this case in its study and that it report to the President.

(5) That there are better methods to arrive at scientific fact than have been employed.

The Institute's committee has been continued and will report on further developments.

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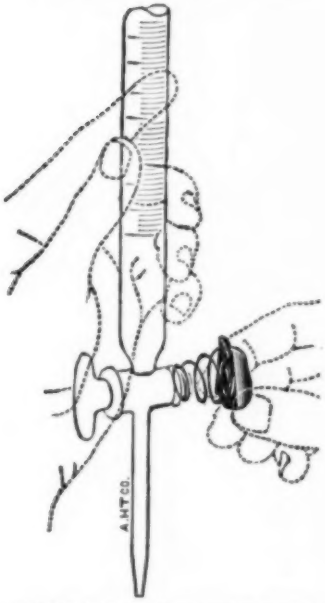

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3291-B. In position on stopcock plug of a Burette.

3291-B.
Side view of Stopcock Tension Clip.

3291-B.
Rear view of Stopcock Tension Clip showing spring opposed jaws.

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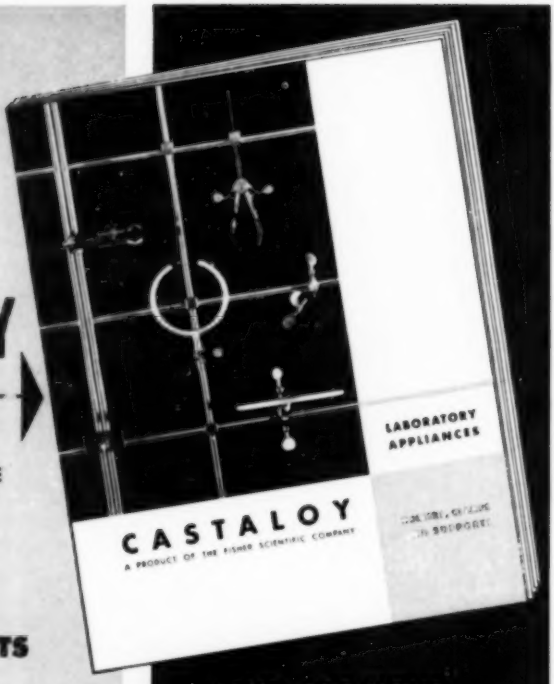

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New Responsibilities for Members of the Professions

Dr. J. C. Warner, Hon. AIC

President, Carnegie Institute of Technology, Pittsburgh 13, Pa.

(Acceptance Address when the Gold Medal of THE AMERICAN INSTITUTE OF CHEMISTS was presented to him, May 13th, in Philadelphia, Pa.)

IN A free society professional men and women have an obligation to serve society in a broader sense than merely serving their clients and employers with technical competence in their fields of specialization. Each of us — doctor, lawyer, scientist, engineer, minister, etc. — has the added obligation to accept full responsibility as a citizen of a community, a state, our nation, and the free world. In this regard it seems to me that scientists and engineers have a special responsibility because our civilization has depended increasingly upon science and its applications in a multitude of technologies. As a consequence our public problems, both domestic and international, have steadily increased in complexity and they with increasing frequency contain scientific and technological elements. I am convinced that we must depend more and more on help from our professional people in finding solutions to our problems if we are to go forward and preserve our free society.

"We must depend more and more on help from our professional people in finding solutions to our problems if we are to go forward and preserve our free society."

Our situation in America has changed substantially during the past half century and this change must be reflected in scientific and technological education as well as in the obligations assumed by professional scientists and engineers as practitioners and as citizens. Let us take a brief look at this change in our situation: The last quarter of the last century and the first decade of the present century was an era of tremendous industrial development in America, accompanied by a corresponding development in transportation and communication. Literally hundreds of new enterprises were established each year, but almost invariably they were small industries, short transportation lines, and local communication systems. In these relatively small enterprises the technology was simple by present-day standards. In this period we depended heavily upon Europe for new basic science as well as for much of the new technology. Industry and commerce wanted, and under the circumstances needed, practically-trained

young men who could do useful things immediately upon graduation. In this same period social, economic, and political problems in the United States seemed relatively simple. They were largely domestic and rarely had difficult technical aspects. As we sat comfortably between two oceans with friendly Canada to our north and usually friendly neighbors to our south, world problems seemed remote and of minor importance compared to the economic development of our country.

It was natural that scientific and technlogical education should be intensely practical and that little thought should be given to the education of the scientist and engineer so that he could discharge his responsibilities as a citizen. It was still considered that public problems could be adequately solved on a basis of tradition, precedent, hunch, opinion, and surmise by politicians ignorant of science and technology and their implications.

Since the first decade of the present century our situation has undergone a drastic change:

1. Our industrial enterprises are giants operating on a country-wide or even a world-wide basis. They are marvels of complex technology and require the services of thousands, almost millions of competent, alert, and creative engineers and scientists. Great emphasis must be placed on efficiency in the use of materials and energy, on the continuous development of labor-saving devices so that manpower can be multiplied by a steadily increasing factor through the use of energy from inanimate sources, on the use of automatic controls, on quality control and the steady improvement of products, and on the effective integration of technical development and control with management and administration. In like manner communication and transportation now operate on a continent-wide and world-wide basis. Almost all of these large enterprises have developed in-service training programs for teaching young technical graduates the special methods, techniques and "know-how" of the industry.
2. Modern technology has become so complex that scientists and engineers are now faced with problems which require a new order of creative imagination, and the ability to apply basic principles to entirely new situations. A substantial number of highly trained men capable of meeting this challenge are urgently needed.
3. Two world wars and their consequences added to other orderly as well as disorderly

developments in world affairs have placed the United States in a very different position from that which it occupied at the turn of the century. Whether we like it or not, the United States is a world power of first rank, and we can no longer adhere to a smug isolationist attitude; we must assume a role of responsible leadership in world affairs.

4. Because of the world situation, international problems have become an important element in many of our domestic problems. But without this factor, our public problems have steadily grown more complex through the impact of science and technology on all of our organizations and institutions. Our public problems are no longer amenable to solution by the traditional methods of the past and it seems clear that we must, if we are to survive and prosper as a free society, rely more and more on our professional people for aid in their solution.

Our leading colleges and universities have recognized the changes and a reconstruction of professional education has been accomplished, or is well under way in the great majority of them. Many of our leaders in education have written articles and given public addresses on this subject, and our views and practices at Carnegie Tech have been presented on a number of occasions. Therefore, it seems inappropriate to devote more time to this subject here.

Let me next offer a few examples of public problems which contain scientific and technological elements:

1. *The Atomic Energy Problem.* With the public announcement that atomic bombs had been exploded over Japan near the end of World War II, we were confronted with a multitude of problems, many of which have not yet been solved — international control, civilian vs. military control in the United States, security clearance, exchange of information with friendly countries, development of civilian as well as military applications, the part which free enterprise should play in the development — and a host of other problems. When we were confronted with these problems, it seems safe to say that none of our leaders in the legislative, executive or judicial branches of the Government was competent to propose solutions, and whether our leaders liked it or not, our scientists and engineers had to be called upon for help in finding solutions to these public problems.
2. *The National Security Problem.* How should our resources

be spent for research, development and production of war material to give us maximum security as a people? How can we build a defense against the devices for offensive warfare in the hands of our potential enemy? To find solutions to these important problems we certainly require all the help we can get from our scientists and engineers.

3. *The Food-Population Problem.* Every day we have 7,423 more mouths to feed. Thus by 1973 we shall have 4 mouths to feed for every 3 we must feed now. We must do this with no substantial increase in land area under cultivation. This clearly is a problem that can not be solved without the help of scientists and engineers.

4. *The Public Health Problem.* This one will not be solved by settling the socialized vs. private medical services controversy. It will be solved by supporting research which will conquer the remaining diseases which cripple and kill our people before they have enjoyed a full measure of life and service; by providing good water supplies and sewage disposal systems; and by improving safety measures so that accidents which cripple and kill are more completely eliminated.

5. *International Trade and Aid to Foreign Countries.* It seems to me that we have resorted pretty much to the political and pressure group methods of fifty years ago in handling these problems. I would like to see an objective, scientific study of the comparative effects on our standard of living in America of (a) the current "give-away" program of direct aid to bolster the economy of foreign countries, and (b) permitting freer trade between these countries and the United States to provide a comparable improvement in their economy. With anything like a comparable effect on our standard of living, the latter is obviously preferable because it would gain us infinitely more in good will and free world cooperation. I'm sure that we have in America professional people who are competent to make the objective analysis I have suggested.

All of this emphasizes that, in spite of frequent arguments to the contrary, this is the age of science and technology. Under the circumstances it does not seem safe to trust the administration of a modern democratic state to men who are ignorant of the methods of science and of the benefits to mankind which have been made possible through the applica-

tions of science.

When we have leaders who are not competent in this regard, we as members of the various professions have a special obligation to be alert and to express our views on public problems, especially on those which have elements related to our field of professional competence. Complacency on our part could be fatal to the continued existence of a strong free society.

I believe that recent crisis involving the Bureau of Standards illustrates the point I have been trying to make. Although I personally have every desire to support the present administration and I entertain nothing but good wishes for its success, I believe the Secretary of Commerce demonstrated a lack of knowledge of the methods of science and the conditions required if science and technology are to continue their important contributions to society. We of the scientific and engineering professions quickly saw that, in addition to the rather disastrous effect which the arbitrary dismissal of the Director of the Bureau would have on the morale of scientists and engineers in Government employ, two important major issues had been raised:

(1) The scientific integrity of the Bureau of Standards had been questioned.

(2) It appeared that political considerations and the demands of the market place had been allowed to override scientific fact.

It is greatly to the credit of scientists and engineers in America, and to their societies and associations, that these issues were not ignored. The response was magnificent and we have, as you know, won the first round. But having won the first round, let's not relax in complacency. Let's insist that proper decisions be made on a basis of the findings of these committees. In this as in other public problems let us always be on the alert, meeting our full responsibility as professional people and as citizens. If we fulfill this obligation we can have high hopes that America will give leadership to the free world and that we shall continue to prosper as a strong free society.

Appointed: Dr. Charles L. Thomas, F.A.I.C., as associate director of the Research and Development Department of Sun Oil Company, at Marcus Hook, Pa. He was formerly manager of the company's research laboratory at Norwood, Pa.

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John C. Warner

Dr. Walter J. Murphy, F.A.I.C.

Editor, The American Chemical Society

(A condensation of an address given when Dr. Warner received the Gold Medal of THE AMERICAN INSTITUTE OF CHEMISTS, Philadelphia, Pa., May 13, 1953.)

THERE is no more pleasant and satisfying assignment than to discuss the accomplishments of J. C. Warner — educator, author, teacher, chemist, chemical engineer, outstanding inspirational leader in the chemical profession, and just good plain friend to thousands.

The "J" stands for John, not Jake, although John Warner is known to thousands by his nickname, Jake. The "C" stands for Christian and, in every act in his public, professional, and private life, Jake Warner has been guided by the strong Christian principles of faith, hope, and charity, inculcated in him by his mother who was a country school teacher.

This short, powerfully-built, dynamic Hoosier grew up on an Indiana farm near Goshen, a town which he usually explains with, "You know, Land o' Goshen." He is an outstanding example of the small-town lad who goes to the big city and makes good.

The second of four sons, he is descended on his paternal side of the family from South Germans, who came to America in 1847, and on his maternal side, from early Indiana settlers who combined English, French Huguenot, and Pennsylvania Dutch. The mixture that flows through his veins is just as varied as the mixture of tobacco he smokes in his short-stemmed pipe. His oldest brother, DeMain, now owns the family farm near Goshen and is director of the Indiana State Farm Cooperative. A younger brother, Harold, is superintendent of maintenance of the New York Central Terminal Division in Chicago; and the youngest son in the family, Paul, is a district sales manager for the Insulite Company.

As a country school teacher, Jake's mother had a strong, indeed, a fervent determination that Jake would have the benefit of a college education. Early in life he demonstrated a marked interest in science which his mother noted with keen delight. Because of his strong love for the State of Indiana, young Warner selected Indiana University. He received the A.B. in 1919, the M.A. in 1920, and the Ph.D. in 1923. University records show that he earned academic honors, a letter in wrestling, and his nickname. While at Indiana he also acquired a wife!

Louise Hamer was a student in a qualitative analysis class taught by young, graduate instructor Warner, and evidently both the teacher and the student found fine qualities in each other and a strong mutual attraction, for in a few years, they were Mr. and Mrs. Warner. They are the proud parents of two wonderful sons, William Hamer Warner, and Thomas Payton Warner, both students at Carnegie Tech.

Louise Hamer was a member of Delta Gamma sorority, and Jake belonged to Delta Upsilon. Many years later at a testimonial dinner for Dr. Warner, a college friend said of him, "Jake could pass anything at Indiana University — except the Delta Gamma house."

During the hours when he was not visiting the D. G. house, he studied hard enough to be elected to Phi Beta Kappa and Sigma Xi; became president of his fraternity, and played a speedy halfback in football and a sweet violin in the college orchestra. Jake made several touchdowns by employing the unorthodox procedure of running between the legs of the opposition. The important point, however, is that by either climbing over the opposition, or digging under it, he frequently landed between the goal posts with the precious pigskin in his possession. This is learning the facts of life the hard way, but Jake has always worked and played hard. He is never lukewarm about anything.

In Jake's early career, he had some experience in industry as a research chemist. He was with the Barrett Company for a short period in 1918, and with the Cosdon Oil Company in 1921, temporary positions which he held while studying at Indiana. Upon completion of his work for the Ph.D. degree, he became associated with the Wayne Chemicals Corporation for two years, and continued on as an instructor in chemistry at Indiana University.

In 1926, Jake cast his lot with Carnegie Institute of Technology as an instructor in chemistry. In 1928 he was made an assistant professor; in 1933 associate professor of theoretical chemistry; in 1936, associate professor of metallurgical engineering; two years later he was named professor of chemistry and head of the department.

When Carnegie planned a marked expansion of its graduate program in 1945, Dr. Warner was appointed Dean of Graduate Studies in the College of Engineering and Science. In 1947, he assumed, in addition to his other responsibilities, that of assistant director of the College of Engineering and Science. In 1950, he was elected president of Carnegie — one of America's great schools of science and engineering. Under his guidance it has grown and prospered phenomenally in the past three years.

A recent article by Benjamin Fine in the New York Sunday *Times* points out the growth of Carnegie Tech by comparing the 1940 budget of $1,755,274 with the 1953 figure of $3,157,000.

The Carnegie Program

Carnegie has a program of cooperation with industry to help students, the college, and business, and this broad farsighted approach reflects the thinking of the man who now heads the institution. Largely under his initiative, Carnegie has developed a program integrating liberal arts and technical and scientific courses. The four years at Carnegie gives the students a sound program of technical courses and the humanities. Nearly fifty per cent of the engineer's time is devoted to non-engineering courses. Some twenty-five per cent is given to courses in the humanities and liberal arts — subjects such as English, history, philosophy, literature, economics, and logic. It is not enough, Dr. Warner believes, to give a man a competent background in his own professional field; it is equally important to give him sufficient background to be a valuable member of the community.

Carnegie Tech has five objectives for its integrated engineering-liberal arts program:

1. Fundamental knowledge in the fields covered by the student's curriculum, and the ability to use this knowledge.
2. Genuine competence in the orderly, analytical thinking which professional men and scientists have always used in reaching sound, creative conclusions.
3. Ability to learn for one's self with scholarly orderliness, so that after graduation the student will be able to grow in wisdom and keep abreast of the changing knowledge and problems of his profession and the society in which he lives.
4. The philosophical outlook, breadth of knowledge, and sense of values which will increase the student's understanding and enjoyment of life and will enable him to recognize the moral, economic, and social aspects of his professional problems.
5. The breadth of ability, and the capacity to communicate ideas to others, which will enable him to use his professional powers effectively in dealing with all aspects of the problems of his profession and with those problems which he will meet as a citizen and a person.

Indeed, this is a large order and Dr. Warner would be the first to admit that not every student grows in stature along the lines of these objectives, but the amazing thing is that a high percentage do. This in turn reflects the dynamic personality of the man who heads the organization, it indicates qualifications of greatness.

War Work

Dr. Warner was away from Carnegie campus for a two-year war leave in 1943-45. He directed and coordinated research in the laboratories of the University of Chicago, University of California, Iowa State College, M.I.T., and at Los Alamos, in the highly confidential work on the purification of plutonium, a vital part of the development of the atomic

bomb. He later participated in operation of the Clinton Laboratories, Oak Ridge, Tenn. In his war work, Dr. Warner was closely associated with Monsanto Chemical Company and Dr. Charles A. Thomas, F.A.I.C., now president.

Frequently I have heard Charlie Thomas speak in glowing terms of the outstanding services performed by Dr. Warner as coordinator of the vast research program in more than a half-dozen of the largest research laboratories. I have seen Jake function as a coordinator in several American Chemical Society activities. The secret of his success is infinite patience and a thorough grasp of every detail. He has still another characteristic that has stood him in good stead — a rich sense of humor — so essential in times of mental stress. Charlie Thomas, speaking of Warner on the occasion of the presentation of the Pittsburgh Award said, "Dr. Warner showed an intuitive sense of balance in his job of coordinator of the wartime plutonium work and could usually put the finger on the weakest portion of the experimental data."

Some Personal Characteristics

Warner is a straight thinker who never straddles once his mind has been made up. One of the finest examples of clear and objective thinking I have read in years was his paper on "The Professor and His Public," delivered late last year before a joint meeting of the ACS and AIC in New York.

Still another characteristic that has been instrumental in his rise is that quiet dogged determination he possesses. Jake thrives on difficulties. In the early days of his career at Carnegie, power in the laboratories was automatically turned off at 11 p.m. by order of the business manager, who apparently failed to realize that many kinds of research projects operate around the clock. Jake and one of his students, Paul Fugassi, now a popular professor of chemistry at Tech, were not to be stopped by a mere ruling of a business manager when they wanted to study the kinetics of a very slow reaction. They assembled gas-fired vapor thermostats, storage batteries to operate relays, and continued despite the business manager. Gas and kerosene lamps were brought in so periodic readings could be taken. The two men took turns on the night shift for several months, and Mrs. Warner became another physical chemistry widow. She did play a role in the research project, however, because she had to wash the lamp chimneys like the pioneer women of old. The power service at Tech is now on a 24-hour basis.

A firm friendship developed between Charlie Thomas and Jake Warner as a result of their association in the atomic energy project. Jake was a man of mystery for those

two memorable years. His wife Louise knew little about his work and why he was absent from Pittsburgh almost continuously. The patience and trust she placed in him is highly commendable and a great tribute to their strong bond of mutual love.

Dr. Warner has been an active author. He is co-author of two widely-used textbooks (*General Chemistry*), now in its third edition; *Experimental General Chemistry*, in its fourth edition, and a laboratory work-book entitled, *General Chemistry Problems*, now in its third edition. He is also the editor and co-author of the fifth edition of Leighou's *Chemistry of Engineering Materials*, and author of over fifty scientific papers in the field of physical chemistry and electrochemistry.

Professional Accomplishments

The Gold Medal of THE AMERICAN INSTITUTE OF CHEMISTS is not given for scientific achievement but rather for outstanding contributions to the professional welfare of the chemist. In this respect the AIC medal is most unique. It is the only award I know of with this single objective. The man we honor richly deserves the high honor associated with the AIC medal. His name adds great luster and prestige to the award.

It is most fitting, therefore, to stress J. C. Warner's professional contributions and accomplishments. He is a member of Phi Beta Kappa, Sigma Xi and Alpha Chi Sigma. He has long been active in the affairs of the Electrochemical Society. In 1937 he was chairman of the Pittsburgh Section of this organization; in 1949 he became a director, and three years later, president.

Dr. Warner is a fellow of the New York Academy of Sciences, a member of the American Institute of Mining and Metallurgical Engineers, American Society for Engineering Education, and currently is serving on the Commission on Higher Institutions of the Middle States Association of Colleges and Universities. He is a founder member and president of the Pennsylvania Chemical Society.

He has been a councilor of the American Chemical Society since 1937. He was chairman of the Society's Pittsburgh Section in 1941. In 1945 he was honored by his own section when he was awarded the Section's Pittsburgh Award "for outstanding service to chemistry." He was elected a director-at-large of the Society in 1948, and is now serving a second term on the board. He has been chairman of the board's most important committee, the Committee on Publications, since it was established several years ago. The large number of important offices held by Dr. Warner in the ACS demonstrates the high regard which his fellow chemists have for him, but it does not convey the full significance

of his outstanding services to the Society.

When the Society's new constitution was being drafted, following the publication of the famous Hancock Committee Report, there were many differences of opinion as to the manner in which the Society should be reorganized . . . It was no easy task to bring these various factions together and to reconcile their differences. Warner and others literally spent days during the crucial period in drafting a new constitution. As a result of these labors, the Society has continued to move forward and the chemical profession owes a debt of gratitude to Dr. Warner and those associated with him.

The next great service performed by our medalist for the American Chemical Society was, and fortunately still is, in the field of publications. The operating budget of the Society is now somewhat more than $4-million a year (really big business), and of this figure approximately 80 per cent represents publication activities . . . Under Dr. Warner's guidance the American Chemical Society publication program is functioning actively, with many resulting benefits. Within the past three years several progressive steps have been taken, such as the decision to publish JACS on a semi-monthly basis; the acquisition by the Society of the *Journal of Physical and Colloid Chemistry* and the establishment of the *Journal of Agricultural and Food Chemistry*. Still other innovations and improvements are currently under consideration . . .

The American Chemical Society is not the only organization to benefit from the wise counsel and outstanding leadership of Jake Warner. He knows his way around business and financial institutions. I understand these are rather essential attributes of a university president in this day of high costs and dwindling income from endowments. Jake is a member of the board of directors of the Jones and Laughlin Steel Corp., also a member of the Advisory Committee of the Oakland Office of the Mellon National Bank and Trust.

Civic Affairs

Jake is also active in civic affairs. Undoubtedly every college president is expected more or less to participate in the civic life of the community, but Jake's interest is one of long standing. He is an excellent example of the professional man who leaves the "Ivory Tower" frequently in order to fulfill an obligation we all owe to society.

Currently he is a member of the Sponsoring Committee of the Allegheny Conference on Community Development. He also serves on the Civic Board of Pittsburgh Playhouse, the Board of the Civic Light Opera Association, and the Board of the Pittsburgh Symphony Society. Obviously he still thinks in nostalgic

dreams of the sweet violin playing on warm summer evenings in Indiana.

Our medalist maintains a lively interest in all phases of the development of atomic energy. This is but natural when one recalls how closely associated he was with the field during World War II. It was not surprising to those who knew something of his work during World War II in this field, when President Truman appointed him in October a member of the General Advisory Committee to the Atomic Energy Commission. The General Advisory Committee is a very active body, and frequently Warner is in Washington for meetings at the AEC headquarters. The country is fortunate to have Dr. Warner as member of this committee at a time when many momentous decisions must be made in the near future. His scientific knowledge along with his well-known business and administrative talents will be the basis for much practical service to the commission.

Dr. Warner's informal manner is the direct antithesis of what one expects in a president of one of the country's leading institutions of higher learning. When you step into his home you are immediately at ease. Louise and Jake do not stand on ceremony. I have never known any home where a more friendly atmosphere prevails. I recall several pleasant evenings in the upstairs sitting room — the most recent occasion listening to Louise and Jake report on their experiences during their trip to India where they were the guests of the Tata Iron and Steel Company, Ltd. On this trip, Jake delivered the Perin Memorial Lectures at Jamshodpur, and addressed the Indian Science Congress in Calcutta.

No man has ever been blessed with a better helpmate than Jake. To Louise should go a generous share of the credit for his highly successful career. Her charm is so great that we tend to forget she also has played the role of constructive adviser. I know Jake has found her a deep source of inspiration.

John C. Warner: You richly deserve the high honor about to be conferred upon you. It must be a source of keen satisfaction to you to know that thousands in your profession appreciate deeply the services you have performed for them individually and collectively in a most unselfish manner and without any thought of personal reward. You typify the ideal professional man. Unselfishly you have served your profession: you have demonstrated in numerous ways that the mark of the true professional is largely the services rendered to others. The INSTITUTE in honoring you honors itself and every member of it.

See page 323 for the story of the Medal Award Dinner.

Dr. Gustav Egloff (second from right) presenting the Gold Medal to Dr. Warner. Left to right, Dr. E. R. Weidlein, toastmaster, Dr. Work, and Dr. Murphy.

Citation

JOHN CHRISTIAN WARNER, *educator, author, teacher, chemist, and chemical engineer, for his contributions to the chemical profession throughout a career which has been of service to his country and an inspiration to his students and fellow chemists, has been selected as the* 1953 *recipient of the Gold Medal of The American Institute of Chemists.*

Appointed: Dr. John H. Payne, Jr., F.A.I.C., as senior research group leader in the research department of Monsanto Chemical Company's Phosphate Division, St. Louis, Mo. He joined Monsanto in 1944 and received the Ph.D. degree from Purdue University in 1947.

Selected: Dr. Adolf C. Elm, F.A.I.C., of The New Jersey Zinc Co., to present the fifth Joseph J. Mattiello Lecture at the Annual Meeting of the Federation of Paint and Varnish Production Clubs, at Chalfonte-Haddon Hall, Atlantic City, N. J., Oct. 29-31, 1953.

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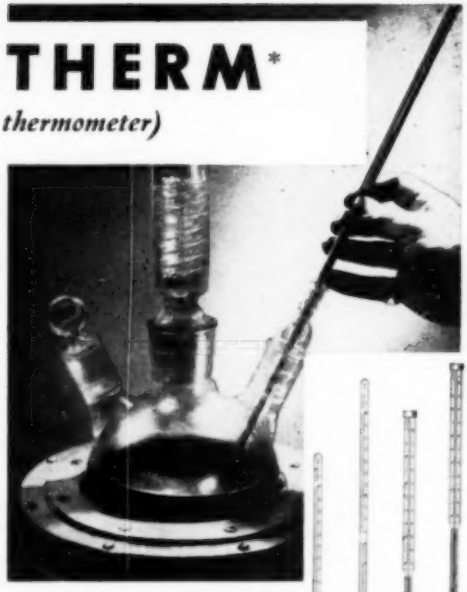

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↑ "Adjustatherm", which works like a trombone, shown in actual use.

→ Note both sizes are available with standard taper or semi-ball joint.

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No. J-2298	Thermometer only, 11½" long	—	11.00
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No. J-2299-1	SB 18/6 Adapter only	3.75	3.75

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Quo Vadis?

Dr. Lincoln T. Work

AIC President

(Introduction to the General Session at the Thirtieth Annual AIC Meeting.)

"Not what we have, but what we use; not what we see but what we choose — These are the things that mar or bless the sum of human happiness."

—Clarence Urmy, "*The Things That Count.*"

THROUGHOUT our training and professional careers, each of us may appropriately ask himself "Whither goest?" This question, objectively answered, may furnish a plan for a balanced and happy lifetime, marked by worthy achievement. A realistic approach will avoid the pitfalls of Pollyanna optimism and of despondent pessimism. It will give positive force to the steps we take, and stir us from lethargy and procrastination. Applied as a test at stated intervals, it will give an approach to the quantitative in evaluating progress toward our goals. And it should include the whole person in his relations to his professional service and to his fellow-man.

The inherent aptitudes which are our individual heritage become developed and directed through what we do in childhood and in youth. In those years, we test our aptitudes and find those to develop while at the same time we fail to develop others. As the years pass, these abandoned talents — let us hope they are the minor ones — cease to be a source of power to us. Those which we do develop — let us hope that they have the greatest potentiality — become the source of strength. It might seem that we choose the path of least resistance; but we can remember the law of electricity, the path of least resistance is the path along which the most current will flow for a given applied potential. However, for happiness and effectiveness in the later years, it is usually well to develop breadth in all of one's aptitudes, and to sacrifice the minor ones consciously when they exact too great a price in developing major talents.

In school, let us assume that we have shown special ability in science. The process of narrowing this to a specific branch of science can be a gradual one through high school and college years. Selection of the right place to study becomes important as this trend develops. It should be one having a well qualified staff. Often during those years, we find inspiring teachers who make some field especially clear and give our talents the impetus to develop in that direction. Too little recognition has been given to those great souls in the teaching

profession who have had a part in guiding many to useful lives.

As a field, chemistry needs good men rather than many men. Knowledge, imagination, ability to plan, and the ability to work with people are essential attributes. It is true that this is a time of shortage where there is competition for graduates among employers, but it should not be concluded that a mass migration into chemistry would solve the essential problem of enough good men for the posts of responsibility.

Conditions which have prevailed in recent years have presented the young graduate with a real problem. His senior year has often been one interview after another. Long before commencement, the student may have received more offers than he can possibly digest. A decision has had to be made between so many well portrayed positions that he is both proud to be in such demand and puzzled as to which to choose. When he has chosen, he may well feel that he has picked the best possible place; but, when he begins to work, he becomes a freshman in the school of life and may feel disillusioned. One employer I know prefers to find men who have spent a year or two in their first jobs. Possibly having made some mistakes and certainly having a more realistic approach, they make this next decision on a better basis.

The wise graduate avoids the pitfalls of a poor choice for his first position. He has learned through conversation with acquaintances, through laboratory and factory visits, and through summer work just what he will face when he starts. He will not let himself go to the highest bidder, but he will choose a post that pays properly, offers him breadth of experience and further training, and shows him the pathway to growth for effectiveness in the years ahead.

The great digression for young men in science is the period of military service. Our leadership, confused between the democratic concept that all men are created equal and the actual need for a growing group of young, technical men to serve the industrial arsenal of democracy, has fumbled badly for more than a decade. Military leadership has dominated civilian, and no suitable basic principle as to where men best may serve has been steadily applied. The remedy in process of preparation may develop a logical plan upon which a young man can count for a period of time.

The real problem in military service is specific to each person. It may be a digression from science, but there are compensations. A man can proudly remember that he has taken an active part, out of his real field but side by side with other fellow-Americans, in insuring our way of life. He learns to work with his fellows, and though regimented more than is best for creative minds, he

learns the lines of authority as a part of effective organization. If military service be a part of one's experience, let him make the best of it, ready to return when through with his service to the plan of life he has formulated.

Somewhere in this period, the chemist begins to think of establishing a home and a place in the community. It is not often easy, since the chance for growth within a company often means transfer and travel during the early years. Happy is the man whose family homogeneity and whose ability to adapt himself in new communities can do what is best for overall growth.

Dr. Leo Baekeland once remarked that he and his contemporaries appeared to be progressing at similar rates in their twenties and thirties, but that, when they reached the forties, sharp differences began to appear. Some men were prepared for high places in science or in business while others were no longer due for major change. This begins the period of the full attainment in one's career. There are problems in each path, and they are the specific problems of each one personally. Well solved, there is happiness for the days ahead. It is over those years that set this background that one may weigh the quotation from Pavlov in his "Address to Russian Students" (1936):

"First gradualness. About this most important condition of fruitful scientific work I can never speak without emotion. Gradualness, gradualness, and gradualness."

Or, to recall Sidney and Beatrice Webb in Presidential Address of the British Labor Party Congress (1923):

"The inevitability of gradualness. Impatience may have its day; but it is not of lasting value."

Changes in position should always be seriously contemplated, because they offer the possibility of greatly enhanced service and equally of failure. A continuously growing career has merit. Yet, there are times when those who have advanced are faced with readjustments. It may be a new top management which changes the organization's philosophy; it may be changed policy due to business conditions; or it may be the organization ceases to be compatible. After sober thought and an effort to cooperate, it may become clear that change is essential. Then is the time to re-evaluate one's self, again ask "whither goest?"

To some, it must be another salaried position; to others it may be

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opportunity for independence. In the latter case, new and broader requirements exist for success. Experience, financial ability, salesmanship, and ability to get on with people are requirements which one who has served on salary with a narrowing technical experience may find insurmountable. Adaptation to a new task and a new environment is usually a problem. The services being rendered by management consultants in finding, testing, placing, and advising help to give men opportunity through change and help to keep them from the pitfalls in a new advanced position. It has been my experience to see men faced with change at that point and to see some rising to greater opportunity through help from others.

In these days of greater longevity, provision for years of retirement is essential. Most companies have retirement funds, some are contributed to by the employee. A very precarious type is the one in which the company contributes all, and pays only if one is still employed to retirement. Best practice is to recognize that retirement funds are a part of service and that the employee has a fully vested interest in the value accrued during his years with the company. The retirement problem is one of adjustment. Special university posts offer a service of value to the man and the school, for how else can a school acquire such value in experience to help another generation? Others are trying consultation where their experiences may be applied in an ethical manner to non-competitive industries.

Throughout one's career, there can be joy in progress and achievement. In times of personal adjustment — conflict and struggle — we may well find inspiration in Kipling from "Rewards and Fairies":

"If you can keep your head when all about you
Are losing theirs and blaming it on you;
If you can trust yourself when all men doubt you,
But make allowance for their doubting too;
If you can wait and not be tired by waiting,
Or being lied about, don't deal in lies,
Or being hated, don't give way to hating,
And yet don't look too good, nor talk too wise;

"If you can dream — and not make dreams your master;
If you can think — and not make thoughts your aim,
If you can meet with Triumph and Disaster
And treat those two impostors just the same;
If you can bear to hear the truth you've spoken
Twisted by knaves to make a trap for fools,
Or watch the things you gave your life to, broken,
And stoop and build 'em up with worn-out tools;

"If you can make one heap of all your winnings
And risk it on one turn of pitch-and-toss,
And lose, and start again at your beginnings
And never breathe a word about your loss;
If you can force your heart and nerve and sinew
To serve your turn long after they are gone,
And so hold on when there is nothing in you
Except the Will which says to them, "Hold on!"

"If you can talk with crowds and keep your virtue,
Or walk with Kings — nor lose the common touch,
If neither foes nor loving friends can hurt you,
If all men count with you, but none too much:
If you can fill the unforgiving minute
With sixty seconds' worth of distance run,
Yours is the Earth and everything that's in it,
And — which is more — you'll be a Man, my son!"

Having thus portrayed the individual's basis for THE AMERICAN INSTITUTE OF CHEMISTS, I take pleasure in presiding over the ensuing program in which we shall hear definite approaches to specific aspects of this basic theme:

"WHITHER GOEST?"

New AIC Councilors

The Members of **The American Institute of Chemists** have elected the following new councilors to serve three-year terms, ending in May, 1956:

Dr. Harry N. Holmes, Head, Department of Chemistry, Oberlin College, Oberlin, Ohio.

Dr. Harry L. Fisher, Professor, Department of Rubber Technology, School of Engineering, University of Southern California, Los Angeles 7, Calif.

Dr. Charles L. Thomas, Member of Research and Development Staff, Sun Oil Company, 1608 Walnut Street, Philadelphia 3, Pa.

Resigned: Dr. Ed. F. Degering, F.A.I.C., as research manager of Buckman Laboratories, Inc., Memphis, Tenn. to accept assignment as chief, Branch of Chemicals and Plastics, of the Quartermaster Corps. He will be located in Washington, D.C., for about six months, but will move to Natick, Mass., as soon as the new research and development laboratory of the Quartermaster Corps is completed.

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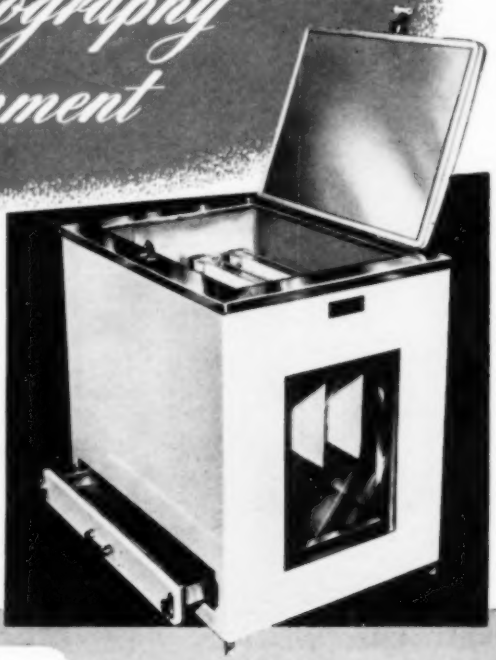

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The Future of Research

Dr. Maurice Nelles

Borg-Warner Central Research Laboratory, Bellwood, Illinois

(Presented at the General Session of the Thirtieth Annual Meeting of The American Institute of Chemists.)

THE future holds an important role for research, although probably not as glittering as the present. We have been looking to research as the agent of progress, and have even considered it a symbol of progress. This is sure to change, for research is just one of the members of the team which can make progress. There are many indications that research will step back in line. Investment companies in the past checked corporations to see that they had excellent research departments. Now they expect excellent research facilities, staff and results, and concentrate on looking for the organization and capabilities to translate the results of research into products and profits. Research is being looked upon as just one of the parts of a machine required for making corporation progress.

One of the reasons research men have been favored, and that research organizations have been able to prosper, is because they have had a monopoly on technically trained men. In the future this will change. Research now covers a wider scope than in the past, when it was primarily to devise new mechanisms. Now, it covers the development of machines, the creation and development of new materials, the important field of creating new methods of manufacturing and the important field of creating new systems. It is as necessary to have intelligent, well-trained men translating the results of research into marketable products and workable systems as it is to have them for research. All of these men must be as creative, and, in addition, must be firmly grounded in business. By 1939 there were many scientific and engineering graduates entering the manufacturing, sales and similar fields. This happened because of an over-supply of talent for research and design. There was a reluctance of the technical people to enter these fields, and they were often not welcomed by non-technical supervisors, who foresaw keen competition. The war changed this situa-

"We are living in an age of opportunity. The future holds progress beyond the scope of anyone's imagination. Research is the key to that progress."

tion, and any technical man could find employment where he wished; and very few have wished to be in work other than research, development and engineering. Now there are indications that in the future there will not be enough of these positions for the graduates from our expanded educational program. However, there is and will be, an increasing need for scientists and engineers in manufacturing, sales, service and finance. The more who enter these fields, the easier it will be to utilize the results of research.

Research in the future will be better managed and more purposeful. This applies to academic and governmental as well as to industrial research. During the past fifteen years there has been a gradual change in the organization of research. Only a few geniuses remain, and team attack of problems has replaced the idea man. Creativeness has become deliberate, and invention has become deliberate. Because of these and other changes, the ways of conducting research and methods of managing research are becoming more effective. In the future, with effective management, some research organizations may become smaller, but more productive. Some of the research which is being done for exercise — the building of bridges that will never be crossed — may be supplanted by research which is purposeful, or at least original.

During my lifetime, I have seen the preponderance of research activity leave the colleges and universities and become a part of industry. I see no reason why this will not continue. When I was professor of engineering research and director of the Engineering Experiment Station at the Pennsylvania State College, which has a very large research program, studies were made to try to determine how academic research should differ from industrial research in the future. It is quite evident that now there is relatively little difference in content or objectives between the academic and the industrial. The conclusions of the studies turned out to be simple and inevitable. Industry will take the low-risk, short-term projects, and the colleges and universities might have the high-risk, long-term projects. If academic research is going to be confined to this type of problem, the universities must be prepared to handle them effectively. Faculties will have to be built which can work as a team, and efforts will have to be largely confined to a few important fields. They will have to be willing to work on important projects, and be patient, for really significant results.

The future holds for those in research a new place in society. Research will be a profession like accounting, engineering and teaching. Thirty years ago, when I indicated my plans to spend my life doing re-

search, my friends had no idea what I had in mind. Now, when the word "research" is mentioned, the reaction is at least favorable. Research workers were pictured as men with small beards, in white coats, working absent-mindedly in a far-away room. Now, people are beginning to realize that researchers look like human beings and are engaged in reputable work. They are more often found in executive suites than in ivory towers. The training and life patterns of research personnel have made them adaptable to many situations, and have made them excellent problem solvers. Their capabilities are now being recognized; and in the future they will participate in a much wider range of activities.

It has been, and will continue to be, fun to do research. It is especially enjoyable and thrilling if one is concerned with the phase of research which is experimentation. Last week, I participated in the evaluation of certain parts of a new oil well drill. I spent four days and three nights in a Southern California oil field. There were many questions to be answered, and plans for obtaining these answers were under way for several months. The final tying together of the results of several smaller research projects into the final experiment was an experience one can never forget. There were all the elements of human emotions in various phases of the experiments. Some men

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had battled day and night with the obstinacies of nature and man to produce a self-contained and actuated nine-station oscillographic recorder which would fit into a standard oil well drill string, and could be lowered into the crust of the earth, where pressures exceed ten thousand pounds per square inch, and temperatures are hotter than boiling water. The whole instrument had to operate in a torrent of caustic mud. The anticipation felt when we lowered the recorder into the hole on the top of a drill was analogous to the feeling when waiting for a surgeon's report on a loved one. The relief and pleasure experienced when the instrument was checked and the film developed were, of course, a thrill. The knowledge that you have created a new instrument to help obtain fuel for the lamps and motors of the world is a satisfaction that makes you want to do more research. It makes you want to continue to be part of the greatest play on earth. A play which few see, but all feel, in their improved living conditions.

Long hours on a project are of minor concern to an experimenter. The whole group in the project last week worked day and night. Individuals would catch naps only when there was a short wait due to unforeseen delays. Last Fall, and earlier, when I participated in the deep diving experiments during which we lowered a man almost a mile into the ocean, there were danger, anticipation, satisfaction, elation, admiration and all the human passions. Men so sick from the rolling of the sea that they could not stand up would not leave, for fear they would miss one event of the experiment. The satisfaction in having helped one man to see a new part of our world is a pleasant memory which will not be forgotten. Tomorrow I will plant the seeds for a new device, which may result in a completely new method of doing a very old operation. The final evaluation will come this Winter. I mention these projects because I know some feel that research is dull, and that it is all test tubes, books and computers. It is these, but also very, very much more.

Research is a way of life, a life with a drive that can only produce results which increase the drive. It is exciting, not dull. It is carried on in the minds of men, and in far and near places in this world and wherever we can devise implements to help or take us.

If the future is to hold much for research, it will be necessary for research to hold much for the future. Each of us has projects in our laboratories and in the laboratories of our minds which would be interesting to describe and discuss here. For commercial and security reasons, we can discuss only a few. I have selected some which I think will be of interest to you, and some that I am reasonably

sure will materialize through research in the relatively near future. Back of certain of the selections is the hope that added interest will be created, so that more will choose to work on the projects.

We are living in an age of metals. There have been some efforts to displace them from their place of eminence by plastics, fibers and cements. In the future, ceramics will be the challenger. The highways and landing strips of the future; bridges; buildings; trains; airplanes and many other structures will utilize ceramic materials. Ceramics are inexpensive, and can be fabricated by mass production methods. They are inherently strong in compression, and are much more durable than steel against wear, chemical attack and weathering. Some ceramic materials have compressive strengths twice the strength of steel. The supply of ceramic material is distributed all over the earth, and it is simple to process. The important deficiencies for ceramics are low tensile strength and low impact strength. However, these weaknesses are overcome by subjecting ceramics to a high initial compressive stress. When a tensile load is applied, it must first overcome this initial compression load before the ceramic

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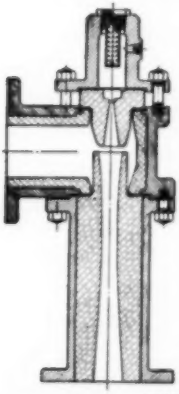

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is put in tension. Experiments show that under these conditions ceramic structures are very resistant to failure by impact. Professor F. R. Shanley, of the University of California at Los Angeles, has pioneered in this work, and has built ceramic structures which show exceptional promise. New ways of prestressing are being devised; and it is felt that, in the future, ways will be found to improve the tensile properties of the material, and make prestressing unnecessary.

The tidelands are sought as places to drill for oil. Why stop with the tidelands? The ocean is still our unexplored frontier. Only one man in the whole world has ever peeked at the great portion of our world which lies over three thousand feet below the surface of the ocean; and Otis Barton took only a fleeting glance in one small area off the coast of Southern California. The average depth of the ocean is about fifteen thousand feet but no one has ever looked below four thousand, seven hundred feet in this great reservoir which covers two-thirds of our world. Otis Barton saw far more life in the deep ocean than has ever existed on land. He found that the greatest concentration of sea life is at about two thousand, five hundred feet: not where fishermen fish. He observed that the deep ocean is not a dark, desolate place, but is brilliantly alive, and lighted by the luminescence of countless millions of sea creatures, ranging in size from the barely visible to several feet in length. No one knows what untold wealth the ocean still holds. We have treated the ocean like the Indians treated the great Midwest. We travel over it, and do not stop to cultivate it to provide for our needs. But we will; and through research we will reap harvests of plants and flesh which will provide for the populations of the future. The bottoms of the oceans may yield minerals and oil in quantities far more abundant than we have ever found on land. The waters of the ocean contain amounts of dissolved minerals which are too large to imagine. Research in the ocean in the future will be important; and the time is here when we should consider abandoning the twelve-mile limit, and stake out a husky portion of the world for our childrens' children.

In the future, research must provide means of collecting the energy from the sun and transforming it into fuels which can be burned in power plants, homes and wherever work is to be done. As our petroleum and coal reserves are used, we must provide replacements. Ultimately, the photosynthetic reactions in the ocean have the best chance of being the means to capture the sun's energy. Research will provide a means to convert the photosynthetic products to chemicals which can be used for fuel or food. In the meantime, pos-

sibly research can find a way to transform plant life into petroleum in much the same manner as nature did millions of years ago. These are long-range, high-risk research projects; and the time will come when it will be a good gamble to risk the necessary research time to accomplish them.

The time for chemical research was never brighter. We have new tools, such as nuclear reactors; and our old ones have never been in better condition. The most serious need is to determine what we should attempt to do. We have a tendency to follow one another from problem to problem and from field to field, much like a flock of pigeons. Today it is petro-chemicals, antibiotics and plastics. What will it be tomorrow? One can only guess. It should be possible for us to synthesize a milk that will be as good as, or better than, cow's milk. One large dairy organization has this as their main project now. Research on the reactions in the bodies of the cows may help production enormously. We were successful in making a butter substitute which has been accepted by over half the population. We should be able to conquer cancer, heart troubles and all the diseases of the body. The chemical research that lies ahead in fields which affect the behavior of the mind may be far more important than that in fields which affect bodily activity. Anger, fear, elation and other human

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emotions may eventually be controlled by means of chemicals. The opportunities ahead for chemists in research are numberless. From my experience in talking to chemical students in high schools, I know that the chemists of the future are going to be as good as or better than those of our generation; and that they will do as good a job with the tools we leave them as we have been doing with the tools we inherited and have developed.

There are fields for research which will yield tremendous dividends. Perhaps the greatest of these is the possibility of increasing the learning rate and decreasing the forgetting rate. A study of our high school and college curricula shows an increasing amount to learn, and that there is very little increase in the rate of learning. It still takes as long to learn algebra, chemistry, etc., as it did forty years ago. This can and will be improved through research. I feel that, with adequate research, average students could learn as much in their four years of high school as they now learn in high school and two years of college. To accomplish this, it will be necessary to apply the techniques of organized research with as much vigor as when we try to develop a new oil well drill. The possibility of altering the forgetting rate seems more remote. We are learning how to remember some of the things we wish to remember. This is especially valuable for technical workers, who rely on their memory for an important part of their work. Possibly some chemists will discover a compound which will cement the synapses and make forgetting impossible.

Thus far, I have covered only a few of the important research fields of the future. You can think of many others. In closing, we should recall that one of the most important fields for research is — research on methods of doing research. I have a feeling that much of the laboratory work that is done could be eliminated if we had better methods of obtaining the results. We must improve our system of recording our successes and failures, so that they will not be unknowingly repeated. In research, failures are usually useful to someone; and in them we can often find a key to success. This is a major problem, and is one of the problems which will have to be solved on a national, if not an international scale. We must continue to improve our laboratory equipment, so that we can do our work faster. We must develop our thought patterns, so that we can reach our conclusions more quickly and accurately. We have lived in an interesting time. We are living in an age of opportunity. The future holds progress beyond the scope of anyone's imagination. Research is the key to that progress. This progress will result in better living conditions for all the people of the world. This is the real compensation for doing research.

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Supply and Demand for Engineers

Dr. Thomas H. Chilton

Chairman, Engineering Manpower Commission
29 West 39th St., New York, N. Y.

(A paper, here slightly condensed, presented at the General Session of the 1953 Annual Meeting of THE AMERICAN INSTITUTE OF CHEMISTS.)

THIS subject is one of the most interesting, important, and challenging of our contemporary problems. It is interesting because it concerns people; important because it concerns our way of life, and challenging because of its many implications and aspects. What I say applies specifically to engineers but these thoughts, facts, and ideas apply equally well to our entire problem of technical and technological manpower.

"What I say applies specifically to engineers but these thoughts, facts, and ideas apply equally well to our entire problem of technical and technological manpower."

I shall not quote lists of statistics and other indications of a shortage of engineering and scientific personnel. Most of you are sufficiently informed of the present statistical situation. Those of us who are concerned with the actual recruiting of engineers and scientists for industry know the problems involved today in finding qualified people. The current statistical aspect of this picture has been emphasized to such an extent that I sometimes feel we forget that, after all, in a problem of this kind, we are dealing with people. Statistical repetition has also the effect of painting what may be a much too superficial picture of what shows very definite signs of being something with roots far deeper than in the immediate needs of our country.

What we have nowadays in engineering manpower is not just a situation due to the contemporary status of our world but a symptom, a sign of a fundamental change — a trend, in our modern era of science.

The Engineering Manpower Commission, of which I am the current Chairman, was established by Engineers Joint Council in response to a request from the Manpower Office of the National Security Resources Board in September, 1950, to prepare a program "for the most effective utilization of engineers in the national effort and make recommendations as to how such a program could be best administered." The findings of the Engineering Manpower Commission were such that Engineers Joint Council decided to continue

the Engineering Manpower Commission to initiate and carry on a program to alleviate the shortage of engineering manpower which had been revealed by E.M.C.'s studies. The program of E.M.C. has been developed along three main lines.

First, to aid in maintaining the supply of trained engineers; second, to promote the most effective utilization of engineers in maintaining national health, safety, and interest; and third, to aid in establishing the importance of the engineering profession to the national economy. The work of the Engineering Manpower Commission is being carried on by delegates of the professional societies representing engineering education and the major branches of engineering. The work is supported financially by private subscription from those interested in this problem as it relates to the over-all national welfare.

1950, when the Engineering Manpower Commission was started, was the year which contributed the two statistics indicating the paradoxical state of the engineering manpower picture. In the spring of 1950, the accredited engineering schools of our country graduated the largest class in their history, numbering about 48,000. This represented about three times as many as were graduated from our engineering schools in many of the years preceding World War II. In spite of this, however, the entire class, as far as we have been able to discover, was substantially absorbed by our industry prior to the beginning of the Korean conflict. On the other side, the fall of 1950 saw an exceptionally small number of beginning students enter our engineering schools — lower than in 1940! The class of 1954, those, that is, who entered in 1950, will, therefore, be one of the smallest in years, numbering about 17,000 graduates.

These student statistics, of course, were by no means unconnected. In 1949 and 1950 individuals and organizations appraising the size of the coming class of 1950, in the light of our pre-World War II experience, began to predict surpluses of engineering personnel. They actually stated that engineering graduates beginning in 1950 would find narrowing job opportunities and might even find it necessary to become employed initially in some non-engineering activity. Quite often in the past the main responsibility for this has been given to the United States Office of Education, and this bureau prepared in 1949 and issued early in 1950 a bulletin and poster which presented this side of the engineering picture. It is significant to note, however, that estimates and statements of this kind, though they may not have had the effect that the pessimistic Bureau of Labor Statistics prediction had, also came from some spokesmen for the professional engineering societies.

It is easy for us in 1953 to exercise the great American right of hindsight and say that someone was apparently wrong. Such is not my intention. The only reason I utilize the illustration is to make this point, that in all probability there were factors present in the 1949-1950 situation; there were certain fundamental inherent characteristics newly developing in our industrial structure, which those of us who should have known better entirely missed or certainly failed to assign their proper weight. The experience of 1950 would seem to indicate, in other words, that this present engineering manpower situation is more than simple demand and supply relationship having to deal with the present state of military preparedness. There are important factors indicating that certain fundamental changes have contributed to the disparity which exists in the supply and demand figures concerning technological personnel. These factors can be expected to result in a continued rise in the need for engineering and scientific skills — a need having only temporary relationship with any current or future need for military preparedness.

To illustrate this with statistics: The total output of our engineering schools in the four years 1947-48-49-50 was about 146,000 graduates. All of these were absorbed in a period when our expenditures for military hardware were only about $5-billion per year. The usual explanation of this enormous hiring of engineers is that it was needed to satisfy the backlog need created by small classes during the war. This is obviously true up to a point but as usual the real significance requires a bit more probing — as follows.

In 1942 the largest engineering class in the history, till then, was graduated — about 16,000 graduates. If we accept this class as normal for the time, the War, by reducing the classes of 1943-44-45-46 caused a cumulative shortage of 16,000, since only 48,000 were graduated in these four years. When we deduct this from the total of 146,000 which came from 1947 through 1950, and if we further deduct 16,000 as the normal absorption rate for each of the years 1947 through 1950, we find that we should have had an over-all surplus of 66,000. The significant fact is that we actually had by 1951 not a surplus but a marked shortage situation. This seems to be a clear indication that the industrial need for engineers has had fundamental acceleration. Why?

Look, for instance, at what has been happening in the chemical industry, for the past twenty years. There has not only been an increase in demand for its products but for more kinds of products that but a few years ago were unknown to the industry, and now are the basis of an ever-growing part of the annual

product. Is it not true that practically every single new discovery has tended to reveal hundreds of new possibilities that await investigation? The laboratory process that produces a new product should be compared to the opening of a door, not the reaping of a single harvest. The detonation of the first atom bomb was to engineers and scientists not the end of anything but merely one of the significant initial steps in the development of an enormous new field for exploitation — a field with manifold implications for all science and all engineering.

It is not also true that those who staff our industry are requiring engineering and scientific training for functions that, traditionally, have not been thought of as requiring such talent? Such areas include sales, market research, technical services, and many administrative posts. There are exceptions to this. But the idea is sound, and there is every indication that this trend will continue. So there are increasing demands for engineers and scientists not only in positions that quite obviously call for this type of training but in other areas of activity. In addition, the ever-increasing complexity of our modern industry is responsible for this situation and also for an increasing need for non-supervisory engineers. These are some of the broad reasons for the fact that while in 1900 the ratio of engineers to gainful workers was 1 to 250, it is now about 1 to 50. We must also keep in mind that we now have the largest work force in our history.

These are some of the reasons why the Engineering Manpower Commission has thought it wise to carry on a long-range program of interesting qualified young people in engineering as a field of study. We realize full well that emphasizing the opportunities in engineering to high school students today cannot possibly begin to pay off in terms of an increase in engineering manpower until 1957 or later, but we feel that the trends just emphasized will in a healthy economy provide interesting, challenging, and rewarding careers, for many more than would otherwise have taken such training. In general, during the pre-World War II years about 2.5 per cent of the high school graduates in our country entered engineering schools. From an employment point of view the increase in the size of our industry alone since 1939 warrants our looking for 4 per cent of the high school graduates we now have.

From the standpoint of our national well-being, steps to insure an adequate supply of technological personnel for the future are an absolute necessity. It is significant that at the very time that the training of technological personnel in this country began a marked decline beginning in 1950, emphasis in Russia on the

training of such people received a tremendous increase. It is common knowledge that if any future conflict is decided by mere matching of quantitative manpower we are already doomed. We can only hope to maintain our position in the world through the maintenance of our industrial pre-eminence. The lesson is clear — we have in the final analysis no choice.

This truism can be illustrated another way. It is common knowledge among us, though sometimes we overlook the full implications of it, that engineering and science have made our standard of living, our way of life what they are today. In a brief span of fifty years, engineering and science have brought to America higher standards of living and more widespread material well-being than any other nation has ever enjoyed. In a time when all types of manpower are in short supply, what we do now will determine whether or not this progress, this development, will atrophy or will go on to greater significance. Engineers and scientists as professional men must take the leadership in emphasizing this development.

Social scientists, economists, politicians, and educators think in most cases in arithmetic terms; two houses for two families, one vote for one person, one chicken in every pot. As an example, I have said that a new scientific discovery should not be

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compared to a single harvest but rather to the opening of a door. This is a concept that, while it is common knowledge among *us*, would come as a surprise to many non-scientific, non-technical people. They equate our standard of living in 1940 against the number of engineers and scientists employed in 1940 and use that as a prediction of what we will need in 1960. They have no idea that in order to survive, science by its very nature must grow vigorously and free of artificial restraints.

We have reached the geographical limits of our country. We have a good idea of its primary resources, but as C. F. Kettering puts it, we have just begun to knock off and use a few chips in the great quarry of scientific and technological knowledge and understanding on which our modern life is based. This thought was put very well by James Kip Finch, former dean of engineering at Columbia University, when at the second meeting of Thomas Alva Edison Foundation Institute he said, in discussing this same general problem,

> "I am confident that our situation, our faith in continued progress lies in our having achieved or blundered

into, if you will, a better understanding in these last 50 years of the implications of engineering in western life than has been the case elsewhere. There are two sides to the technological story. How to make the most of the potentialities for progress which continued advances and science and technology afford, and how to create an environment which will maintain, will stimulate ever advancing science and technology? In short we must seek not only to use technology in carrying forward the western way of life but to use it in such a way as to encourage its continued development. We have heard many proposals to shape science and technology to demands, needs, and wants. It is equally important that we seek to maintain the technological sources of modern life in a dynamic progressive condition."

The insuring of adequate engineering and scientific education both from a qualitative and a quantitative point of view is essential to this development.

Let me sketch a more practical application of what I meant when I said that people outside of the engineering and scientific profession have failed in a great many cases to grasp the significance of our 20th Century technological development. In its activities pointed toward interesting more talented young people in engineering and scientific careers, it was inevitable that the Engineering Manpower Commission should become interested in our high schools and other pre-college training and educational institutions. When this campaign began to result in increasing numbers of our high school graduates applying for admission to our engineering schools, we began to hear complaints from deans of engineering that a discouragingly high percentage of these people were not equipped to begin courses in engineering without retraining in specific subjects or without taking certain subjects for the first time. We thought at first that this was primarily the result of poor guidance work and counseling in the high schools, and in many cases it was. But upon further investigation it became increasingly clear that many of our high schools are not even offering courses that are necessary in preparation for a collegiate career in an engineering school. We found, too, that the prevalence of the so-called elective system of selecting courses in high school gave talented young people the option of taking the immature view and in many cases avoiding pre-engineering courses because they were somewhat more difficult than the other electives. The disappearance or de-emphasis of these elements of intellectual discipline from our schools could only result in the loss of many capable youngsters to engineering and science, which require precise thinking and a high degree of intellectual discipline.

We have, for instance, a preliminary report from the United States Office of Education to the effect that 50 per cent of the high schools in this country do not offer a program which will prepare a student for en-

trance into an engineering college. In one of our most progressive and leading industrial states, not a single one of the seven state teachers colleges, which are the principal sources of high school guidance counselors and of high school science and mathematics teachers in that state, offers a comprehensive program in science. We are short of adequate numbers of high school science and mathematics teachers not only because they are going in more profitable work but also because they simply are not being trained to a sufficient degree. In a sense no one can be blamed for this development but engineers and scientists. We have failed to provide the leadership in an activity in which only we can possibly know the vital way. We have failed to insist on scientific training in the age of science.

In addition to the various guidance programs and the emphasizing of the opportunities in engineering for young people as a more immediate solution to the shortage of engineers and scientists, we in E.M.C. have tried to emphasize the need for maximum utilization by industry of its engineers and scientists. Significant progress can be and has been made along these lines. Many companies have in the past two years found it necessary, proper, and profitable to give engineers more responsible jobs and to remove them from the more routine aspects of engineering activities. Much can be said for better utilization at this end of the employment scale. However, with the more mature and experienced personnel the picture becomes more complex and somewhat more diversified, and certain unexpected elements enter. For reasons stated earlier, an increasing number of industries have found it expedient and proper to employ engineers in so-called non-engineering activities. Also many engineers after they have some industrial experience find that their abilities and their desires are stronger along lines that are tangent to engineering activities but not primarily engineering. In short, engineering has afforded them a wonderful general background as well as an excellent technical training. There are some important implications here for free men in a free society. There are those in our country who see no alternative, in the event of another grave emergency or war, to some sort of national service system. In a society such as ours there is only one reason that can ever seriously be advanced for such a system — extreme urgency caused by manpower defi-

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ciencies that will force government to place people where they are judged to be most needed. It is not a rash prediction to say that if tomorrow we had a large-scale war strong arguments for some such system might indeed be seriously advanced. But if we continue steps to insure the continued health of engineering and scientific training this eventuality perhaps by 1960 would not be quite as necessary.

One of the questions perhaps most often asked of those who are engaged in the expansion of training in engineering and science is this: What will happen in the event of an economic recession or in the event of a change, miraculous though it may be, for the better as far as the world conditions are concerned? Answering this question might in itself be the subject of several talks, but there are some thoughts that may be worth mentioning here. In the first place, we should not look upon the possibilities for the expansion of engineering education as unlimited. There have recently been several important fundamental studies of our human manpower potential, our intellectual potential, and the implication of these is clear that if engineering and science were to receive their proportionate share of the 17 per cent of our annual high school crop who are talented enough to go on to training in science and engineering, the maximum number of engineering graduates we could get in the best year would be in the neighborhood of 45,000-50,000, — about as many, indeed, as we adequately absorbed in 1950. It is fair to state that the possibility of a depression or an economic recession is not primarily a personnel problem but an economic one. The professions of engineering and science can do no less than prepare adequately for the maximum needs of our country from a technological point of view. No one has ever been able to describe to me the disservice we might be doing to either a student or to society in encouraging talented young people to become trained and educated in engineering and the sciences. It has been my observation that in time of economic stricture the only profession, if it can be called that, for which demand remains the same or in all probability increases is that of the politician. Conversely, in such an economic situation I, for one, would rather be hunting for a job equipped with an engineering or scientific training than with any other type of higher education. In any event, in our manpower problems, as in many other phases of modern life, it is incumbent upon engineers and scientists to make their view known, to make their needs known, because we are the only source of such vital information. We would be doing a distinct disservice to our country to fail to get across the engineering and scientific manpower message just as

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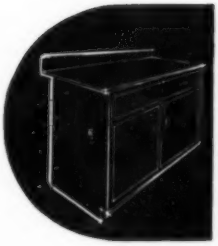

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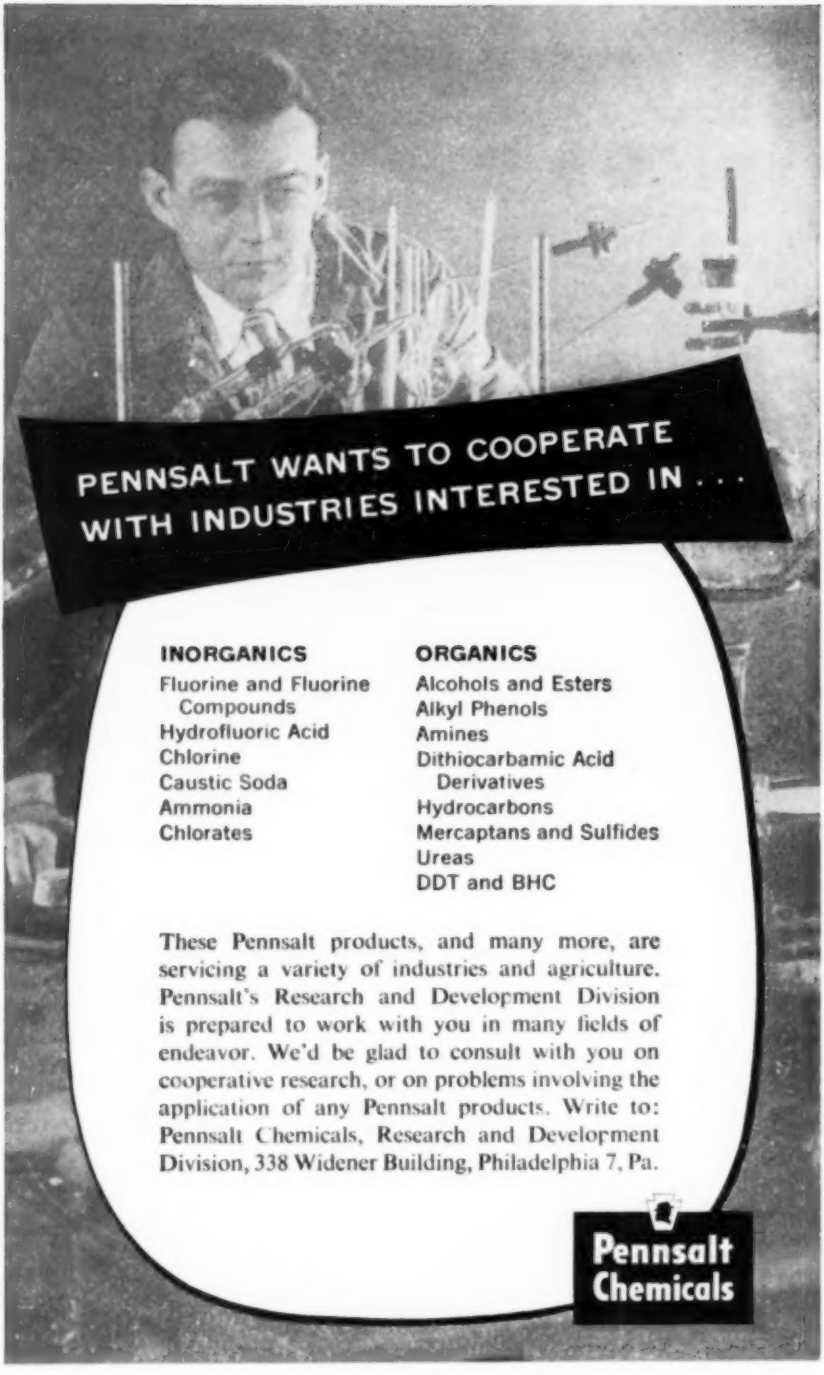
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The Thirtieth Anniversary Meeting of the AIC

THE Thirtieth Annual Meeting of THE AMERICAN INSTITUTE OF CHEMISTS took place at the Benjamin Franklin Hotel, Philadelphia, Pa., May 12th and 13th, with the Pennylvania Chapter acting as host. Following the coffee hour on the morning of the first day, members of the INSTITUTE met to take part in the Annual Business Meeting, where the president, secretary, editor, Chapters, and committees presented reports for the year. The election of Dr. Harry L. Fisher, Dr. Harry N. Holmes, and Dr. Charles L. Thomas, as new councilors, was announced.

The situation at the National Bureau of Standards (See THE CHEMIST, May, 1953, page 229) was brought up for discussion, and the following resolution, presented by a Committee headed by Dr. M. L. Crossley, was adopted:

> The National Bureau of Standards has an enviable record at home and abroad for excellent scientific work. It must not be required to produce results to satisfy special interest, big or small.
>
> We urge that in the re-evaluation of the functions and objectives of the Bureau, as proposed by the Secretary of Commerce, that due weight be given the necessity of maintaining its disinterested position and scientific independence.

Charles E. Peterson, architect, National Park Service, spoke during the informal luncheon, on "The Restoration of the Historical Areas of Philadelphia," illustrating his interesting lecture with slides.

During the afternoon, two concurrent sessions were held. Session A covered a panel discussion on "The Intangibles which Surround Research Administration," led by Dr. R. H. Boundy, vice president for research of the Dow Chemical Company. The speakers were: C. C. Brumbaugh, director of research and development, Diamond Alkali Company; R. F. Brown, general manager of research and development, Spencer Chemical Company; Dr. N. A. Shepard, chemical director, American Cyanamid Company; J. M. Tinker, director, Jackson Laboratory, Organic Chemicals Department, E. I. du Pont de Nemours & Co.; W. A. LaLande, Jr., manager, research and development, Pennsylvania Salt Manufacturing Company, and Karl Pfister, director of Process Research, Merck & Company.

Session B, on "Recent Advances in Medicinal Chemistry," had as its chairman, L. Earle Arnow, Ph.D., M.D., director of research of Sharp & Dohme, Inc. Speakers were: J. M. Ruegsegger, M.D., director of clinical research, Lederle Laboratories, American Cyanamid Company; Joseph J. Bunim, M.D., chief, Arthritis and Rheumatism Branch, National Institute of Arthritis and Metabolic

Diseases, National Institute of Health; Lawrence B. Hobson, M.D., Ph.D., associate medical director, E. R. Squibb Division, Mathieson Chemical Company, and William P. Boger, M.D., medical director, Sharp & Dohme.

That evening, AIC members and guests met in friendship at an enjoyable Social Hour made possible by the Industrial Toxicology Laboratories, 34th and Chestnut Streets, Philadelphia 4, Pa.

Wednesday morning began with a panel discussion on "Evaluation of Technical Personnel," led by W. R. G. Bender, psychologist, of the Employee Relations department of E. I. du Pont de Nemours & Company. Panel members were: Dr. Allyn Munger, Standard Oil Company (New Jersey); Dr. M. V. Taylor, American Institute of Research, Pittsburgh, Pa., and Dr. P. Van Wyck, Hercules Powder Company.

Session D covered "Recent Advances in Industrial Chemistry," under the chairmanship of C. P. Neidig of White, Weld and Company. Speakers were: R. M. Lawrence, General Development Department, Monsanto Chemical Company; S. F. Radtke, Pigments Department, E. I. du Pont de Nemours & Company; R. Adams, Minnesota Mining & Manufacturing Company; J. T. Coe, sales department manager, Chemical Division, Silicone Products Department of General Electric Company, and Roger Williams of Roger Williams, Inc.

Honor Recipients Luncheon

At the Honor Recipients' Luncheon, those attending met Gold Medal recipients, Honorary Membership recipients, and the current recipients of the Chapter awards. Dr. Emil Ott, director of research, Hercules Powder Company, acted as toastmaster. Among the honor recipients who attended this luncheon were: Dr. Frank G. Breyer, Hon. AIC, Dr. M. L. Crossley, Hon. AIC, Gold medalist in 1947; Dr. Gustav Egloff, Hon. AIC, Gold Medalist in 1940; Dr. August Merz, who received the 1953 Honor Scroll of the New Jersey Chapter; Dr. Walter J. Murphy, Hon. AIC, Gold Medalist in 1950; Dr. William T. Read, Hon. AIC; Prof. E. Emmet Reid, Hon. AIC; Bernard E. Schaar, who received the 1952 Honor Scroll of the Chicago Chapter; Dr. Foster Dee Snell, who received the 1952 Honor Scroll of the New York Chapter; Dr. E. R. Weidlein, Hon. AIC, and Dr. P. A. Wells, who received the 1952 Honor Scroll of the Pennsylvania Chapter. Those who received the Gold Medal of the INSTITUTE are also given Honorary Membership. Therefore, featured at the luncheon was the presentation of Honorary Membership, by President Lincoln T. Work, to Dr. J. C. Warner. Dr. Lauren B. Hitchcock, chairman of the Committee on Honorary Membership, an-

nounced that Honorary Membership during the fiscal year, 1953-1954, would be presented to Prof. Walter G. Whitman, Ray P. Dinsmore, F.A.I.C., and Francis J. Curtis, F.A.I.C.

General Session

The general session that afternoon was opened by Dr. Lincoln T. Work, with "Quo Vadis?" the question that every chemist should ask himself at intervals. Dr. Maurice Nelles, director of Central Research, Borg-Warner Corporation; Dr. Thomas H. Chilton, chairman, Engineering Manpower Commission, Engineers Joint Council; Robert F. Moore (author of "How Am I Doing?"), General Manager, Richardson, Bellows & Henry, and his colleague, Dr. Elliott Danzig, contributed information about the manpower situation and the things that the individual should know to help him progress faster in his career.

For the ladies attending the Annual Meeting, Mrs. Hillary Robinette arranged an automobile trip to the fabulous, former du Pont home, "Winterthur", at Wilmington, Del., now a museum of antiques dating back to pre-Revolutionary War days.

Medal Award Dinner

Through the courtesy of Fisher Scientific Company of Pittsburgh, Pa., those attending the meeting then enjoyed a friendly reception to the medalist, Dr. J. C. Warner.

Dr. Edward R. Weidlein presided with wit and ability at the Gold Medal Dinner, where Dr. Walter J. Murphy spoke on the achievements of Dr. J. C. Warner. Dr. Gustav Egloff, chairman of the AIC Jury on Medal Award, presented the medal to Dr. Warner, who responded with "New Responsibilities for Members of the Professions". (See page 277), a paper of especial significance at this time.

Other fine papers presented at the Annual Meeting appear in this issue of THE CHEMIST, or will appear soon.

The AIC is grateful to all those who took part in the program, to those who arranged it, and to the Pennsylvania Chapter for its hospitality and attention to details. The Thirtieth Anniversary meeting has been outstanding among many good meetings.

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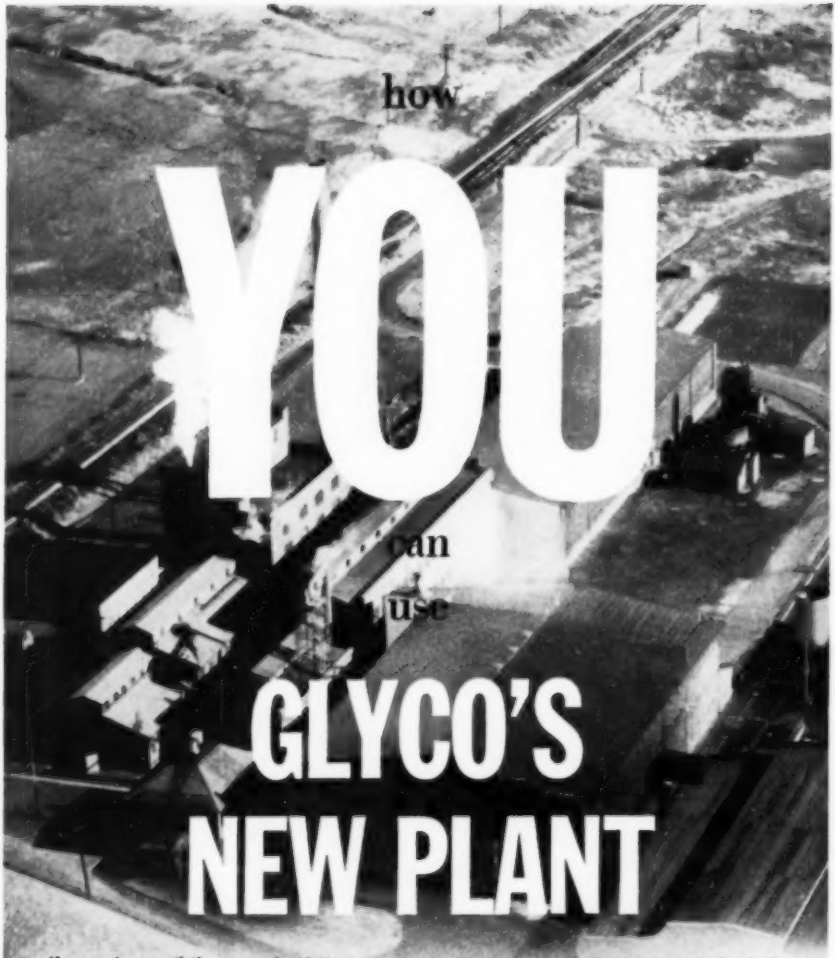

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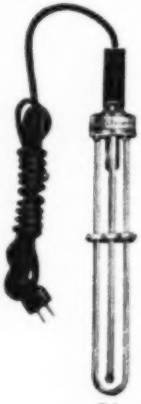

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Leather Fatliquors
Rayon Crepe Soaking
Rayon Hosiery Yarn Treatments
Silk Soaking Oils
Worsted Fiber Lubricant

EMULSIFIED RESINS
Providing:
Adhesive Ingredients
Latex Extenders

FATTY ESTERS
Providing:
Aluminum Rolling Oil Additive
Copper Rolling Oil Additive
Insecticide Emulsifiers
Linseed Oil Extenders
Penicillin Fermentation Defoamer
Textile Finishing Aids

SULFATED FATTY ESTERS
Providing:
Paper Rewetting Agents
Textile Wetting and Rewetting Agents

EMULSIFIED SOLVENTS
Providing:
Dry Cleaning Aids
Paper Stock Defoamers
Textile Yarn Scouring Aid

FATTY AMIDES
Providing:
Dry Cleaning Assistants
Laundry Washing Aid
Paper Felt Washing Compound
Textile Detergents
Wax Dispersing and Emulsification
Wool Fulling and Scouring Oils

EMULSIFIED PARAFFIN WAX
Providing:
Beet Sugar Defoamers
Paper Sizing
Textile Fabric Finishing Aid

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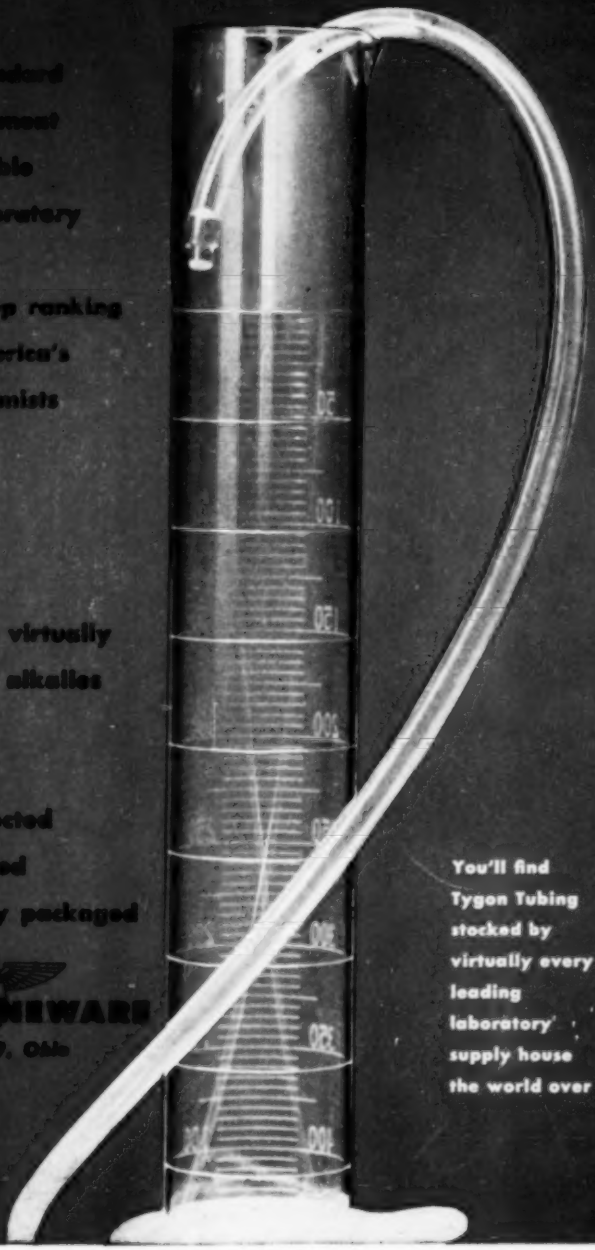

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